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THE EFFECTS OF CULTIVATION SYSTEM ON WATER USE EFFICIENCY AND YIELD IN MAIZE (*ZEA MAYS* L.)

Keywords: corn, cultivation method, monoculture, crop rotation, yield, water use efficiency (WUE), productivity index (YR).

Maize (Zea mays L.) plays a fundamental role in global agriculture. Statistical data from 2023 indicate that this species, with a cultivated area exceeding 208,23 million ha, ranks second after wheat, surpassing rice. Globally, in 2023, over 1,241,56 million tons of maize grain were produced, with the United States of America, China and Brazil leading in this production (FAOSTAT 2025), which in many regions is the basis of the human and animal diet. The versatile use of corn covers practically all branches of industry. In addition to direct consumption, it is used as energy and bulk feed, as well as a raw material for the production of biofuels, cellulose and adhesives. In addition, corn is an important substrate in the pharmaceutical, construction and furniture industries (.

The research was conducted in 2017-2019, in a static field experiment established in 2004 at the Agricultural Experimental Station in Grabów (Masovian Voivodeship), belonging to the Institute of Soil Science and Plant Cultivation - State Research Institute in Puławy. The experiment was established on a lessive soil developed from light clay, classified as a very good rye complex. The field experiment was established using the long strip method with mirror images of objects in four replications. The experimental factor was the methods of maize cultivation in monoculture. The control object was maize cultivation in crop rotation.

The aim of the study was to determine the effect of different soil cultivation methods (plow, simplified and direct seeding) under corn cultivated in monoculture

and crop rotation on grain yield, one of the productivity indices - yield reduction index (YR) and water use efficiency (WUE.

The highest corn grain yield was obtained in 2018, which was characterized by more favorable weather conditions during the vegetation period. In the first and third year of the study, the method of cultivation significantly affected the corn grain yield. In 2017, the grain yield of corn grown in monoculture in direct seeding and simplified tillage was higher, by 32.9% and 12.2%, respectively, and in 2019 – by 36.0% and 30.7% compared to crop rotation. In a wetter year (2018), corn yielded at a similar level on all sites (on average 12.8 t ha-1). Corn grain grown in monoculture and direct seeding was characterized by higher moisture than from sites where plough tillage was used. In 2017 and 2019, there was no reduction in the yield of maize grown in monoculture compared to that grown in rotation (indicators have negative values). In 2018, the yield of maize grown in rotation was higher than that grown in monoculture, with the greatest yield reduction recorded where no mechanical treatments were performed and direct sowing was used (zero tillage). The analysis of the research results did not reveal any significant differences in the average water use factor in the subsequent years of the study, except for 2017, which was the least favourable in terms of rainfall. The highest water use efficiency (WUE) was recorded in the drier 2019, and the lowest in 2017.

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